

Superconducting Electric Boost Pump for Nuclear Thermal Propulsion, Phase II

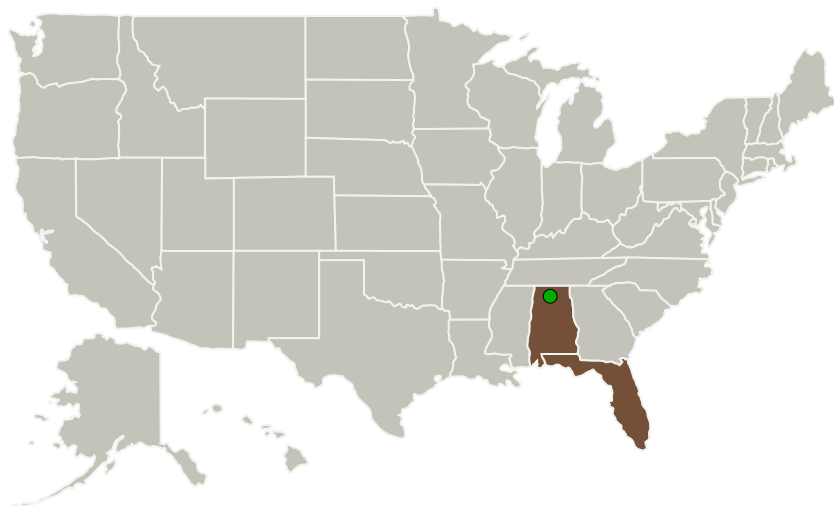
Completed Technology Project (2015 - 2017)



Project Introduction

Design, fabrication, assembly and test of the Florida Turbine Technologies, Inc. (FTT) concept for a submersible, superconducting electric boost pump during Phase II will transition the pairing of superconducting motor and high performance pump technology for use in liquid hydrogen (LH2) from TRL 3 to TRL 6. This innovative solution offers significant performance and operability benefits to future nuclear thermal and conventional chemical propulsion powered cryogenic in-space and upper stage systems. FTT's submersible superconducting electric motor driven liquid hydrogen (LH2) boost pump combines a high performance hydrogen pump inducer along with an electric motor drive using active speed modulation to maintain constant discharge pressure with up to 55% vapor at the inlet. The LH2 environment enables an energy dense superconducting motor that is precisely controlled. This approach substantially reduces the risk of cavitation in the main pump and enables the downstream high speed turbopump to be operated at optimum efficiency with much reduced pressures in the propellant tank. Utilization of the low-cost, near-zero NPSHr electric boost pump permits considerable tank weight savings (as much as 40% for the NTP Mars Mission). The concept also offers significant operability and vehicle performance advantages for new cryogenic upperstage vehicles using conventional chemical propulsion engines.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Florida Turbine Technologies, Inc.	Lead Organization	Industry	Jupiter, Florida
● Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Florida

Project Transitions

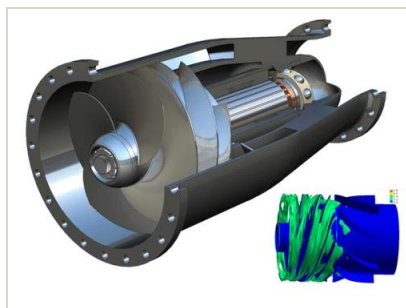
▶ **June 2015:** Project Start

✓ **June 2017:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140731>)

Images



Briefing Chart

Superconducting Electric Boost Pump for Nuclear Thermal Propulsion Briefing Chart (<https://techport.nasa.gov/image/130275>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Florida Turbine Technologies, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

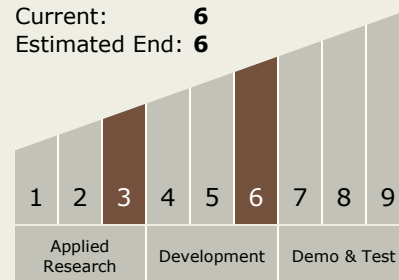
Carlos Torrez

Principal Investigator:

Timothy Miller

Technology Maturity (TRL)

Start: 3
Current: 6
Estimated End: 6



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Technology Areas

Primary:

- TX01 Propulsion Systems
 - └ TX01.4 Advanced Propulsion
 - └ TX01.4.3 Nuclear Thermal Propulsion

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System